Effect of a home- made milk replacer on pre-weaning performance of Nubian male kids

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ABSTRACT

The use of milk replacers to substitute valuable whole milk for suckler goat kids is not widely practiced in the Sudan. The aim of this study was to investigate the effect of two levels of a home-made milk replacer on pre-weaning kid performance, milk consumption, live weight gain, mortality rate and weaning age. Twenty four Nubian male kids of 3 days average age and 3 kg mean live weight were randomly allocated to three treatments each containing 8 kids. Two treatments were offered home- made milk replacer prepared from tallow, egg, groundnut cakes, glucose, minerals and vitamins. Treatment (A) reared on 50% milk replacer and 50% goat milk, while Treatment (B) on 75% milk replacer and 25% goat milk. Treatment(C) was offered whole goat milk and used as a control. All kids were offered goat milk for 3 days as adaptation period. Then, each treatment was offered the allocated experimental milk twice daily through plastic bottle feeders of 500 ml capacity at 8 am and 4 pm. The consumption of milk was measured daily for seven weeks. Body weight and mortality rate were recorded weekly. Samples of milk replacer and goat milk were analyzed for total solid, protein, fat, sugar, ash and acidity. The results revealed that, total solids, protein, fat and acidity were significantly ($P<0.05$) higher in treatment (C) than (A) and (B), however, ash was significantly ($P<0.05$) higher in treatments (A) and (B) than (C).In addition sugar was not significantly different among treatments. Mortality rate was highest in treatment (B) with 100% increase when compared to (A) and (C) 37.5%. Milk consumption, feed conversion efficiency, weight gain, and weaning age were not significantly different among treatments (A) and (C).The study concluded that goat milk could be replaced by50% home-made milk replacer without any deleterious effects on performance of Nubian kids.

INTRODUCTION

Livestock production in developing countries needs greater attention because of its role in food production, livelihood support, and environmental change. One of the major limitations of the livestock sectors in developing countries is the scarcity of feed resources resulting in low productivity and poor growth and reproduction of animals (FAO, 2011).

Goat contributes to the health and nutrition of several million people in developing countries, especially those on the poverty line. Rearing goats provides a small but important supply of animal proteins of high biological value, plus essential minerals and vitamins which are of particular significance for the most vulnerable group namely pregnant and nursing mothers and young children (Devendra and Burns, 1983).

Artificial methods of rearing goat kids are widely used overseas. Although the extensive system of livestock production is generally more economical than the stall fed system, there is considerable loss of young kids due to stress, diseases, unfavorable weather conditions, predator attack, high mortality and inadequate milk production by the nursing mothers, also affects the growth rate of those who survive. The low productivity in ruminants in developing countries is characterized by high mortality, poor growth rate of young ones, delay in the onset of puberty, and long interval between successive parturition all of which are largely attributable to poor feed resources, feeding and management. Further, rearing of young ones is not given much attention. This is largely due to economic compulsion to sell milk for human consumption (Ranjhan, 1992) and maybe not realizing the potential value of these animals in their maturity. Since the young ones are future meat and milk producing stock, it is vital to minimize mortality and improve growth rate.

Kids can be reared economically using milk replacers,The alternative to milk, made from feed ingredients that are not preferred for human consumption ,and weaned at an early age, 6 weeks or less, if adequately grown. Alternative rearing systems are a high priority to producers of goat milk. The advantages include reduced costs, increased production, and breaking disease cycles. The success of rearing kids using milk replacers requires strict adherence to correct management practices, particularly in ensuring good hygiene in rearing facilities, and cleanliness of feed and feeding equipment.

In the Gezira state one day old kids are sold to secure milk for human consumption. This practice resulted in greater mortality in kids and loss of greater biomass from those animals. Therefore, this study was designed to rear kids on a home- made milk replacer for saving milk for human consumption.

MATERIALS AND METHODS

Location

This experiment was conducted in the Goat Research Centre of the Faculty of Agricultural Sciences, University of Gezira Wad Medani, (latitude 13 ° N and longitude 33˚ E, Gezira State, Sudan).

Animals

Twenty four healthy Nubian male kids of 3 days old were bought from *Elkaraba* market. The kids suckled their mothers from birth to 2 - 3 days old. Animal owners usually sell 2-3 days old kids for the sake of milk. The mean body weight was 3 kg and they were divided randomly into three groups according to the type of milk they will receive. Each group consisted of eight kids. Group A received 50% normal milk and 50% home- made milk replacer while group B received 75% milk replacer and 25% normal goat milk. Group C (control) received normal goat milk brought from the market. All the types of milk were offered through plastic bottle feeder with a rubber nipple.

Housing

The experimental animals were accommodated in pens of 3 × 3 x 1.5 m made of a wire net. Each pen was provided with water and fodder. This was mainly for training the animals for consuming dry feed.

Animal Feeding

Fresh goat milk was purchased from the market and offered to all kids for adaptation and training of suckling. The adaptation period lasted for 3 days before conducting the experiment during which the milk offered through 500 ml plastic bottle feeders with rubber nipples. The kids were fed twice a day, at 8 am and at 4 pm and milk consumption was measured daily.

Live weight gain

Animals were weighed weekly till the end of the experiment.

Preparation of milk

Milk was filtered using a plastic strainer and then in the plastic container with a rubber nipple placed to be suckled by kids.

Preparation of milk replacer

Milk replacer was prepared by mixing the ingredients in a liter of water using a blender. The main important step in the preparation was to emulsify the animal fat (tallow) with bile that was brought from the slaughter house and a small amount of warm water in the blender thoroughly until it forms emulsion. Thereafter, 157 g ofl egg were added and mixed with the emulsion. Then glucose, groundnut cake (GNC) and minerals and vitamin were added (Table 1).

Table 1. Composition of milk replacer (g) and calculated chemical composition.

Ingredient	Amount		Chemical composition		
	(g)	%	CP (g/kg)	Energy(MJ/kg)	Fat(g/kg)
Tallow	20	07.2	-	0.75	20.0
Egg	15 7	56.3	17.60	3.67	15.7
Glucose	50	17.8	-	0.21	-
Groundnut cakes	27	09.7	13.11	0.31	-
Mineral	24	08.6	-	-	-
Vitamin	01	00.4	-	-	-
Total	27 9	100. 0	30.71	4.94	35.7

Weaning

Kids were weaned gradually by reducing the amount of milk consumed and number of feeding per day. Then they were weaned after 7 weeks. After weaning, the main feed was composed of concentrate and roughage.

Mortality rate

Mortality was recorded weekly and calculated as the ratio of the number of dead kids to the total number of kids in the pen multiplied by 100.

Chemical analysis of milk

Proximate analysis of milk replacer and goat milk were carried out in the laboratory of Agricultural Research Corporation, Wad Medani, for moisture content, total solids, proteins, fats, sugars, and acidity using the procedures of AOAC (1990).

Statistical analysis

Data were statistically analyzed using SPSS computer program.

RESULTS AND DISCUSSION

Table 2. Proximate analysis of the different types of milk.

Parameter %	50% milk Replacer +50% goat milk (A)	75% milk replacer+ 25% goat milk(B)	100% goat milk (C)	S.E ±	Prob. level
Total solids	12.00[b]	11.30[c]	13.00[a]	0.30	.001
Protein	2.65[b]	2.45[c]	3.00[a]	0.13	.016
Fat	3.60[b]	3.58[c]	4.00[a]	0.22	.027
Sugar	4.80	4.90	4.50	0.22	.074
Ash	0.96[a]	0.95[b]	0.71[c]	0.05	.031
Acidity	0.13[b]	0.10[c]	0.16[a]	0.01	.004

Means within each row followed by the same letters are not significantly different at ($P \leq 0.05$).

Table 2 revealed that, total solids, protein, fat and acidity were significantly higher in goat milk compared to both types of milk replacer, however ash was significantly higher in milk replacer than goat milk. Sugar content was not significantly different among treatments,. Many authors used milk replacer for rearing young animals (Banon *et al.* 2006, Bodruzzaman *et al.* 2015 and Ali *et al.* 2016). Sultana *et al,* (2014) used milk replacer prepared of skimmed milk powder, maize, ground soyabean and soybean and oil. The author, used skimmed milk as the main source of protein, while maize ground soybean and soybean oil as sources of energy .However, in this study, egg, and groundnut cakes were used as sources of protein, glucose and tallow were incorporated as sources of energy. The components of the proximate analysis of milk replacer in this study were lower than those reported by Aufy *et al.* (2009) who found 14.4%, 3.60% and 3.60% for total solids, protein, and fat respectively this is mainly due to the differences in ingredients used.

Table 3. Weekly consumption of goat milk and milk replacer (liter/animal).

Week	50% Milk replacer and 50%goat milk	100% Goat milk	S.E ±	Probability level
1	3.18	2.49.	0.37	0.10
2	5.98	4.85	0.37	0.01
3	6.65	5.55	0.42	0.03
4	6.74	6.34	0.34	0.64
5	7.48	7.11	0.42	0.17
6	6.77	6.75	0.25	0.94
7	2.80	2.80	-	-
Total	39.60	36.10	1.14	0.08
Means	5.60	5.10	0.17	0.08

NB: Group C which received 75% milk replacer and 25% goat milk was completely lost.

Table 3 shows that animals consumed significantly ($P \leq 0.05$) higher milk replacer compared to goat milk in week 2 and 3. In weeks 1,4,5 and 6 there was no significant differences in consumption between the two types of milk . The average weekly consumption of milk replacer was 5.6±0.4 and 5.1± .032 kg, respectively. This result was higher than that reported by Kanwaldeep *et al.* (2014) for Beetal kids which consumed 4.368±12.33 kg/week goat milk. However, there was no significant difference in total consumption between the two types of milk This comparable consumption of milk replacer in this study may indicate that the recipe was as palatable as goat milk

Table 4. Main effect of milk type on feed conversion efficiency.

Type of milk	F.C.E	S.E±	Sig
50% milk replace and 50% goat milk	0.108±0.01	0.02	0.100
100% goat milk	0.133±0.04		

Table 4 shows no significant difference in feed conversion efficiency between the two type of milk. This result indicated that both types of milk were almost similar. However, the results of this study for both groups of animal was lower than that reported by Tahmasbi *et al.* (2007) for both Angora and Cashmere kids and that reported by Smith and Bosman (2004) for Tennessee and Spanish kids. This difference may be due to the type of milk replacer and goat breed used by authors.

Table 5. Weekly percent mortality rate.

Week	50%milk repacer+50% goat milk(A)	75%milk replacer +25 goat milk(B)	100% goat milk (C)
1	0	0.00	0.00
2	12.5	37.5	0.00
3	0	25.0	12.5
4	12.5	0.00	12.5
5	12.5	37.5	12.5
Total	37.5	100,0	37.5

Table 5 shows no significant difference in mortality rate between 50/50 milk and 100% goat milk. However, 75/25 milk resulted in 100% mortality.

Table 6. Effect of feeding milk replacer and goat milk on average weekly weight gain (kg) in pre weaning periods.

Week	Average weekly weight gain (kg)		S.E ±	Probability level
	50% milk replacer and 50% goat milk	100% goat milk		
1	0.55	0.55	0.28	1.000
2	0.40	0.45	0.23	0.233
3	1.01	1.00	0.15	0.361
4	0.36	0.65	0.16	0.109
5	0.69	0.70	0.21	0.614
6	0.45	0.66	0.19	0.161
7	0.85	0.79	0.32	0.159
Mean	4.31	4.80	0.76	0.246

Table 6 shows no significant difference in weight gain between kids which consumed milk replacer and those which consumed 100% goat milk during this period. While only in week 4 animal which consumed goat milk had higher weight gain but not significantly different. However, body weight in week 3 declined in all animals which was probable due due to the environmental effect.

Body weight gain was higher compared to that reported by Hassan *et al*. (2008) and ELkhider *et al.* (1998) for Sudanese Nubian kids. This difference of weight gain might be attributed to the use of restricted milk and concentrates. Also the average weekly weight gain in this study was higher than that recorded by Guney *et al.* (2006) for Damascus kids and that of Khan and Nazninm (2013) for Bengal and Tamunp Jamunapir kids and Ali *et al.* (2016) for black Bengal kids. It is worth mentioning that a sharp drop in weight gain in the milk replacer group was observed at week 4 due to severe diarrhea.

Table 7. Effect of feeding milk replacer and goat milk on body weaning weight (kg).

Type of milk	Weaning weight (kg)	S.E±	Prob.
50%milk replacer and 50%goat milk	5.7±0.48	0.59	0.144
100%goat milk	6.1±1.2		

Table 7 shows no significant difference in body weaning weight between 50% and 100% goat milk types . However, kids which received 100% goat milk had higher body weaning weight though was not significantly different.

The mean weaning weight in both groups was similar to that reported by Ali *et al.* (2016) in black Bengal kids who used NIDO milk, while it was higher than that reported by Khan and Nazninm (2013) for black bengal and Jamunapir goat breed. The weaning age at week 7 in this study was similar to that recorded by Fehar and Savant (1976). However the authors revealed that, weaning at 7 weeks led to only slight growth retardation.

CONCLUSION

It could be concluded that, kids may be reared artificially on 50% milk replacer without any deleterious effects on their performance.

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أثر بديل اللبن المصنع منزلياً على أداء ذكور جديان الماعز النوبي

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الخلاصة

استخدام بدائل اللبن كبديل اللبن الطبيعي في تغذية جديان الماعز لا يمارس على نطاق واسع في السودان. الهدف من هذه الدراسة معرفة أثر بديل اللبن المصنع منزلياً على أداء جديان الماعز قبل الفطام و المتناول من اللبن و زيادة الوزن الحي و معدل النقوق وعمر الفطام . استخدمت 24 من جديان الماعز النوبي (ذكور) في أعمار ثلاثة أيام كمتوسط ومتوسط وزن 3كجم، وتم توزيعها عشوائياً إلى ثلاث معاملات كل معامله تحتوي على ثمانية من جديان الماعز . تمت تغذية مجموعتين أ و ب على البديل المصنع منزلياً الذي تم تجهيزه من الدهن الحيواني و بيض دجاج و أمياز الفول السوداني و جلكوز و أملاح معدنية وفيتامينات. المعاملة الاولى (أ) غذيت على 50% من بديل اللبني و 50% من لبن الماعز و المعاملة الثانية (ب) غذيت على 75% من بديل اللبني و 25% من لبن الماعز أما المعاملة الثالثة (ج) غذيت على لبن الماعز والتي تمثل الشاهد. كل الجديان أعطيت لبن الماعز لمده ثلاثة أيام كفترة أقلمه. غذيت كل المعاملات التجريبية، مرتين يومياً صباحاً ومساءً بواسطه رضاعة بلاستكية سعه 500 مل عند الساعة الثامنة صباحاً والرابعة عصراً. قيس استهلاك اللبن يومياً لمدة سبعة أسابيع و الوزن الحي ومعدل النقوق أسبوعياً. كل عينات اللبن خضعت لتحليل كل من المواد الصلبة و البروتين و الدهن و السكر و الرماد والحموضة. أوضحت النتائج ان هنالك فروقات معنويه على مستوى ($P\leq0.05$) في كل من الجوامد الكلية والبروتين والدهون والحموضة بين المعاملة ج والمعاملة ب حيث انها كانت أعلى في المعاملة ج. بينما كان الرماد أعلى معنوياً ($p\leq 0.05$) في المعاملة أ وب بالنسبة لمستوى السكر في المعاملات لا توجد فروقات معنوية بين المعاملات .اما نسبه النقوق كانت اعلى في المعاملة ب حيث بلغت 100% مقارنه مع كل من المعاملتين (أ)و(ج)والتي تمثل37.5% . قبل الفطام اظهرت النتائج عدم وجود فروقات معنويه بين المعاملات في كلا من المستهلك من اللبن و معدل الكفاءة التحويلية و الزيادة في الوزن وعمر الفطام . خلصت الدراسة الي انه يمكن استخدام 50% بديل اللبن من غير اي تأثير ضار على أداء جديان الماعز النوبي .